Processing Hot Peppers Like Cotton

Innovations improve both pepper handling and cotton ginning.


PEGGY GREB (K11722-1)

PEGGY GREB (K11726-1)

PEGGY GREB (K11716-1)

PEGGY GREB (K11728-1)

Ed Hughs is determined to save chili peppers and cotton for New Mexico growers. Hughs is an agricultural engineer with ARS's Southwestern Cotton Ginning Research Laboratory near Las Cruces. Heavily grown in southern New Mexico, cotton and chili crops are important to both the state's economy and psyche.

The chili pepper (also spelled "chile" in many parts of the country) is the state's cultural icon. Chili peppers are to New Mexico what wine is to France. But New Mexicans had to think the unthinkable in the late 1990s as they watched global trade—freed by the North American Free Trade Agreement (NAFTA)—threaten to completely steal their chili pepper market. That market for red chili, green chili, jalapeño, and cayenne peppers still generates more than $400 million in economic activity in the state each year.

New Mexico, eastern Arizona, and far-west Texas produce 90 percent of U.S. chilis and about a third of the country's cotton.

Chili Task Force to the Rescue

Rather than complain about NAFTA, New Mexico agriculturalists decided they would instead seek improved technology—mainly automation—to lower

■ Ed Eaton, New Mexico State University (NMSU) engineer (back) and ARS agricultural engineer Ed Hughs (front) examine trash removed from machine-harvested red chilis by this experimental chili-cleaning machine. ■ Stephanie Walker, NMSU extension vegetable specialist, and Hughs inspect chilis cleaned by the experimental cleaner before sending them to a processing plant. ■ At NMSU's Plant Science Research Center, electronics technician Fermin Alvarado (driving) and sheet metal mechanic James Melendrez (riding) pilot a thermal defoliator through cotton test plots. Agricultural engineer Paul Funk (on the ground) observes and records the machine's performance. ■ Textile technologist Carlos Armijo monitors the performance of a roller gin stand operating at four to six times the standard ginning rate.

costs. Hand labor is limited and expensive and not fast enough to keep up with food-processing plants at peak times. They formed the New Mexico Chile Task Force to coordinate efforts of the chili industry with researchers at New Mexico State University, ARS, and the U.S. Department of Energy's Sandia National Laboratories.

Hughs serves on the task force, sometimes holding meetings at the ARS lab. Research and extension specialists, producers, processors, and plant breeders from the three major chili-growing states also participate. The members have identified as the highest priority the need for an in-the-field cleaner to remove "trash"—sticks and leaves—from harvested peppers.

It may seem strange for a cotton ginning research facility to be working with chili peppers. But it's not as odd as it seems because chili peppers are one of the main crops rotated with cotton in the area. Both crops also face fierce global competition, and both crops have to be harvested and processed with as little trash mixed in as possible.

Chili pepper harvesting is at about the same stage that cotton harvesting was 50 years ago—mostly hand-picked. That proved too costly for cotton, and it's proving too costly for chili peppers. Though growers increasingly use mechanical harvesters, they still don't have any mechanical cleaners in the fields and have only limited ones in processing plants.

Hughs and colleagues at the ginning laboratory worked with the chili pepper task force to invent a pepper-cleaning machine. They used their experience with automated cotton ginning for the initial design. It consists of a roller table that conveys harvested chilis and trash through a series of rotating cylinders. Small sticks and leaves fall out in the first stage, the peppers exit through gaps in a later cylinder stage, and larger trash is carried away in the last cylinder stage.

"Leaves and stems lower the market quality of peppers if there's more than 5 percent trash," says Hughs. "And trash degrades the color that gives red chili peppers their chief economic value as a source of a safe, natural dye.

"In the past, hand labor had the advantage of removing all this trash, giving you pure peppers. But things have changed, and the pressures of today's fast pace mean that hand labor is not only time-inefficient and very expensive, it's also no guarantee of a trash-free harvest. Machines often do a better job today."

The new mechanical cleaner might be used in the field before peppers are boxed for shipment or at the processing plant, but field cleaning would eliminate transporting of trash, and applying sticks and leaves to the soil would return nutrients.

Field cleaning would replace the minimal mechanical cleaning that now occurs before the peppers move onto a grading table where they're sorted by hand, further separating them from any remaining trash. The automated cleaner underwent its second test with the 2004 chili pepper harvest.

Hot Air, Faster Ginning

Another invention at Hughs's lab, a two-row prototype thermal defoliator, offers hot air as an alternative to chemicals for removing cotton leaves before harvest. As the device is driven through a field, its propane heaters blast cotton leaves with heat, killing them. It was successfully tested in fall 2003, with more extensive testing in 2004.

"This defoliation method may be of particular interest to organic farmers," Hughs says. "We have to determine its effects on cotton quality, costs, and labor requirements, but we think it will be competitive with airplane spraying of a chemical defoliant." This research has been financially supported by a cooperative agreement with the Propane Education and Research Council.

Moving indoors to the cotton gins—and to a research project financially supported by the cotton industry through Cotton Incorporated—scientists at Hughs's lab have found a way to modify roller gin stands to quadruple the processing speed for upland cotton. Upland cotton makes up most of the U.S. cotton harvest each fall—about 18 million bales.

As roller stands separate seeds from fiber, they leave longer fibers than do the saw-gin stands that trace back to Eli Whitney's first patent in 1794. And longer fibers bring a higher price. But until the recent innovations, the slow ginning rate for upland cotton made it economically infeasible to use anything but saw-gin stands.

Just a few simple changes enabled ARS scientists to speed up the ginning of upland cotton from one bale to four bales per hour. "Now we can put more of it through the roller stand ginning stage and get a higher quality product," he says.

Hughs says that because cotton and chili peppers are so commonly grown in rotation in his area, devising machinery for processing both crops is a natural way to make the whole local farming system more efficient and economically viable and therefore more globally competitive.—By **Don Comis,** ARS.

This research is part of Quality and Utilization of Agricultural Products, an ARS National Program (#306) described on the World Wide Web at www.nps.ars.usda.gov.

Sidney E. Hughs is with the USDA-ARS Southwestern Cotton Ginning Research Laboratory, 300 E. College Dr., Room 203, Mesilla Park, NM 88047; phone (505) 526-6381, fax (505) 525-1076, e-mail shughs@nmsu.edu. ★